

# M-451 Z Positioning Stage

## High-Load Vertical Micropositioning Z-Stage



M-451.1PD precision elevation stage

- Encoder Resolution 3 Nanometer
- Min. Incremental Motion to 100 nm
- Travel Range 12.5 mm (1/2")
- Load Capacity up to 12 kg, High Stiffness
- ActiveDrive™ Motor
- Non-contact Limit and Reference Switches
- Mounting Platform for P-500 and PIMars™ Piezo-Nanopositioning Systems
- Self-Locking

The M-451 Z-stage series is ideal for high-precision, high-load vertical positioning tasks. These stages feature a precision-machined base of high-density, stress-relieved aluminum for exceptional stability and minimum weight. Precision-cross-roller guided wedges and low-friction lead-screws provide maintenance-free positioning. The stages are self locking to 12 kg.

### Application Examples

- R&D
- Semiconductor technology
- Mass storage device testing
- Metrology

### ActiveDrive™ for High Dynamics

Model M-451.1PD with Active Drive™ provides incremental motion down to 0.2 μm. The ActiveDrive™ design, developed by PI, features a high-efficiency PWM (pulse width modulation) servo-amplifier mounted side-by-side with the DC motor and offers several advantages:

- Increased efficiency, by eliminating power losses between the amplifier and motor
- Reduced cost of ownership and improved reliability, because no external driver is required
- Elimination of PWM amplifier noise radiation, by mounting the amplifier and motor together in a single, electrically shielded case

### High Accuracy with Gearhead/Encoder Combination

Models M-451.1DG are equipped with closed-loop DC-motors with shaft-mounted position encoders and precision gearheads providing 0.1 μm minimum incremental motion and 3 nanometer encoder resolution.

### Stepper Motor Version for Open-Loop Operation

Models M-451.12S models feature a cost-effective direct-drive, 2-phase stepper motor, providing very smooth operation and a resolution of 6400 steps/rev. (with the C-663 controller). Minimum incremental motion to 0.2 μm is possible.

### Limit and Reference Switches

For the protection of your equipment, non-contact Hall-effect limit and reference switches are installed. The direction-sensing reference

### Ordering Information

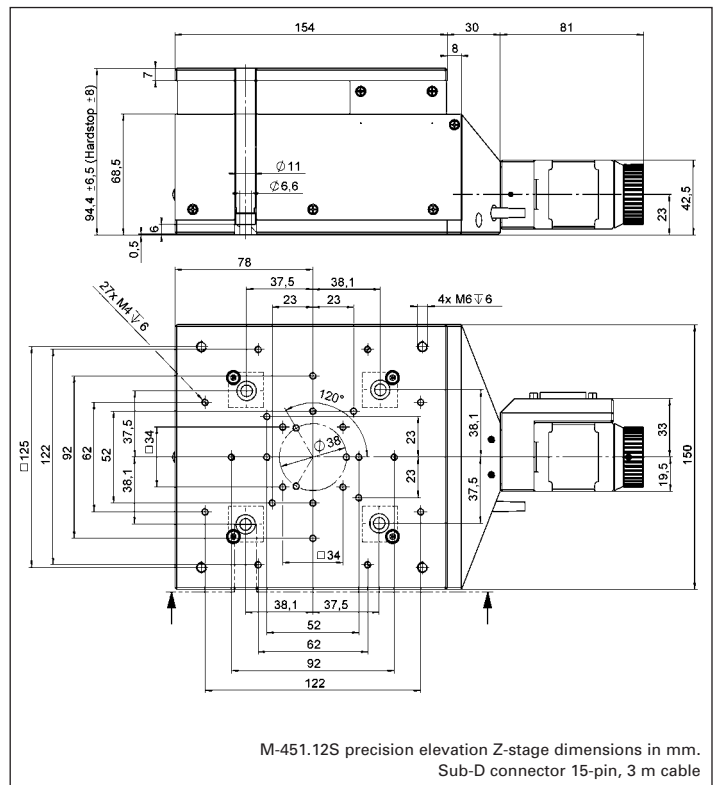
- M-451.1PD**  
Vertical Stage, 12.5 mm, ActiveDrive™ DC Motor (includes 24 V power supply)
- M-451.1DG**  
Vertical Stage, 12.5 mm, DC Motor Gearhead
- M-451.12S**  
Vertical Stage, 12.5 mm, 2-Phase Stepper Motor

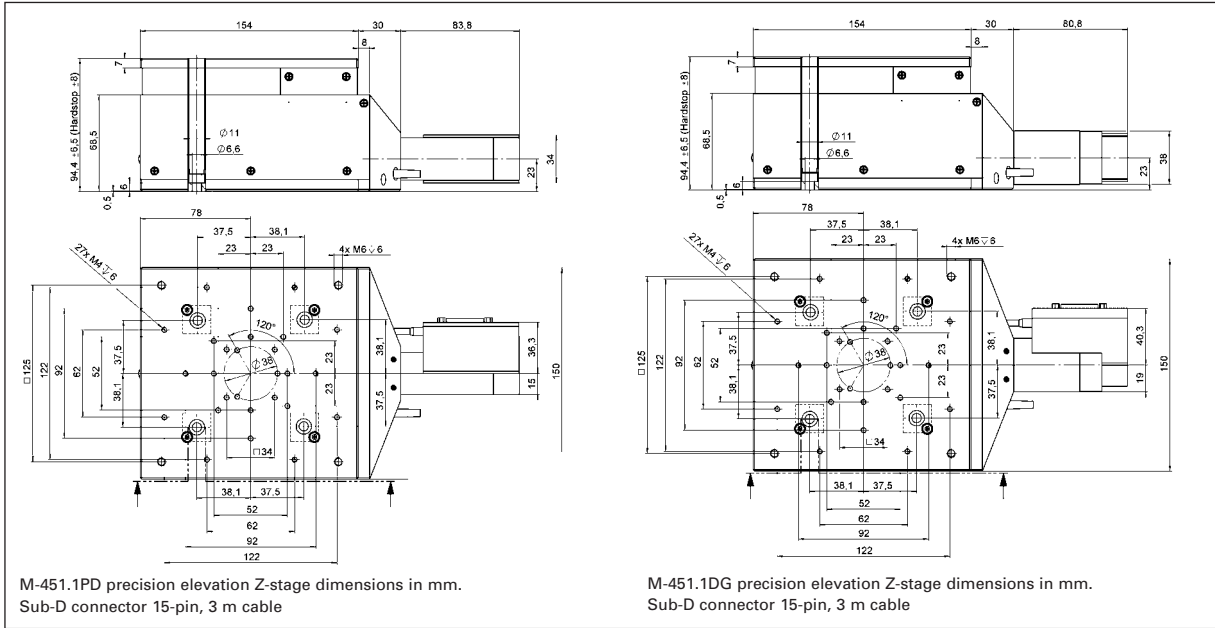
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switch supports advanced automation applications with high precision.

### Compatible with Nanopositioning/Scanning Stages

M-451 is designed to work with a variety of PI piezo nanopositioning stages such as the P-527 series and P-561 PIMars™ series. These piezo-driven positioning and scanning stages provide sub-nanometer resolution and accuracy and very high scanning speed.





## Technical Data

Models	M-451.1PD	M-451.1DG	M-451.12S	Unit
Active axes	Z	Z	Z	
<b>Motion and positioning</b>				
Travel range	12.5	12.5	12.5	mm
Integrated sensor	Rotary encoder	Rotary encoder	-	
Sensor resolution	4000	2000	-	cts./rev.
Design resolution	0.042	0.0028	0.026	μm
Min. incremental motion	0.2	0.1	0.2	μm
Backlash	1	1	1	μm
Unidirectional repeatability	0.3	0.3	0.3	μm
Pitch/Yaw	±75	±75	±75	μrad
Straightness	1	1	1	μm
Flatness	1	1	1	μm
Max. velocity	3	0.5	0.8	mm/s
Origin repeatability	1	1	1	μm
<b>Mechanical properties</b>				
Drive screw	Leadscrew	Leadscrew	Leadscrew	
Thread pitch	0.5	0.5	0.5	mm
Gear ratio	-	29.6:1	-	
Motor resolution*	-	-	6,400*	steps/rev.
Max. load (self-locking)	120	120	120	N
<b>Drive properties</b>				
Motor type	ActiveDrive™ DC Motor	DC Motor, gearhead	2-phase stepper motor*	
Operating voltage	24	0 to ±12	24	V
Electrical power	25	4	4.8	W
Limit and reference switches	Hall-effect	Hall-effect	Hall-effect	
<b>Miscellaneous</b>				
Operating temperature range	-20 to +50	-20 to +50	-20 to +50	°C
Material	Al (black anodized)	Al (black anodized)	Al (black anodized)	
Mass	5	5	5	kg
Recommended controller/driver	C-862 (single-axis) C-843 PCI board (up to 4 axes)	C-862 (single-axis) C-843 PCI board (up to 4 axes)	C-663 (single-axis)	

\* 2-phase stepper motor, 24 V chopper voltage, max. 0.8 A/phase, 400 full steps/rev., motor resolution with C-663 stepper motor controller



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